SASKATCHEWAN RESEARCH COUNCIL

32ND ANNUAL REPORT 1978

THE RESEARCH COUNCIL ACT, 1965.
Clause 21, in part, directs that:

1. The Council shall on or before the last day of February in each year submit to the Lieutenant Governor in Council a report of its proceedings and transactions during the next preceding calendar year, which report shall contain such particulars as the Lieutenant Governor in Council may prescribe.

2 Every report shall forthwith be laid before the Legislative Assembly if then in session or, if it is not in session, within fifteen days after the opening of the next session.

Regina, February 16, 1979

●

TO THE HONOURABLE C. McINTOSH

Lieutenant Governor of the
Province of Saskatchewan

MAY IT PLEASE YOUR HONOUR:

The undersigned presents herewith, for your consideration, the report of the Saskatchewan Research Council for the year ended December 31, 1978.

Respectfully submitted,

Norman Vickar, Chairman
Saskatchewan Research Council

PLEASE ADDRESS CORRESPONDENCE TO:

Saskatchewan Research Council
30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

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MEMBERS OF THE SASKATCHEWAN RESEARCH COUNCIL

The Honourable Norman Vickar, Chairman
G. L. Gartner, Vice Chairman
D. Murray (Secretary)
G. Birney
T. S. Burton
E. B. Campbell
B. M. Craig
J. Hutch
L. Katz
R. E. Lloyd
K. J. McCallum
P. Melin
B. Michel
G. C. Mitchell
P. Nikiforuk
J. E. Spencer
B. Thompson
E. B. Tinker

EXECUTIVE OFFICERS OF THE COUNCIL'S STAFF

Executive Director ..... T. P. Pepper
Administrative Officer ..... R. E. Melvin
Director of Financial Services ..... R. McGrath

Division Heads

Chemistry and Biology ..... E. M. Coxworth
Engineering ..... W. H. W. Husband
Geology ..... R. G. Arnold
Industrial Services ..... A. Scharf
Physics ..... J. Maybank

101-07600/

PROCEEDINGS OF THE COUNCIL

Membership of the Council increased to 18 during 1978. The act, revised in 1978, allows for a maximum membership of 18.

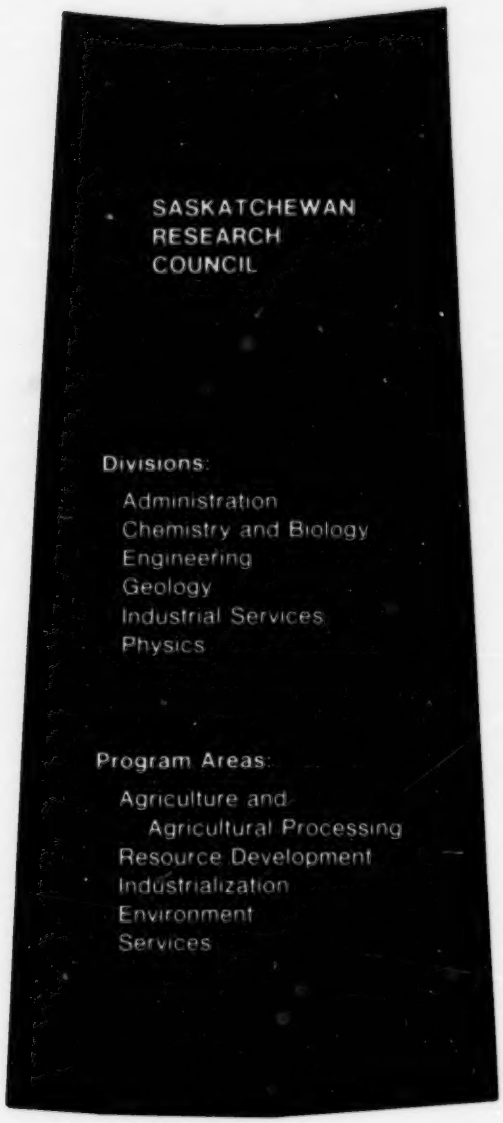
Council officers remained unchanged with the Honourable Norman Vickar, Dr. Gerry Gartner, and Derek Murray remaining respectively as Chairman, Vice Chairman and Secretary.

There were two resignations during 1978. J. E. Fletcher and A. Kavadas left Saskatchewan for Alberta and British Columbia respectively. Council extends grateful thanks to these gentlemen for their considerable contribution to Council activities. Reappointed for a further three year term of office were Chairman Vickar, Vice Chairman Gartner, L. Katz, G. C. Mitchell, and K. J. McCallum. New members appointed to Council were P. Melin, B. Michel, P. Nikiforuk, T. S. Burton and B. Thompson.

The Council met three times during 1978: in Regina on February 10, in Melfort on July 12, and in Saskatoon on December 8, 1978. The main business of these meetings was to receive the reports of the Executive Committee and Executive Director, to formulate policy and priorities for the program of the laboratories, to discuss the 1978-79 program and to provide policy guidance for the 1979-80 program.

The Executive Committee, consisting of the Chairman, Vice Chairman, Secretary, and Dr. B. Craig, with the Executive Director acting as secretary met four times during the year: on February 3, May 11, November 3, and November 30, 1978. The main activities of the Executive Committee were to deal with routine administrative matters of the laboratories and, in conjunction with Council Management, to prepare policy and major administration program items for discussion by the Council.

INTRODUCTION



The range of activities in the Council's program continued to broaden. This fact is seen in the change in name of the Division of Chemistry to the Division of Chemistry and Biology to reflect the significant portion of that Division's Environmental Impact Studies that falls within the biological sciences. It is seen also in the revision of section 10 of the Research Council Act under which

> "The Council shall take under consideration matters pertaining to research, development, design, consultation, innovation and investigation in the natural and management sciences, pure and applied, as they affect the welfare of the province, and any particular matters that may be brought to its attention by the Lieutenant Governor in Council"

is substituted for

> "The Council shall take under consideration matters pertaining to research and investigation in the fields of the physical sciences, pure and applied, as they affect the economy of the Province of Saskatchewan, and such particular matters as may be brought to its attention by the Lieutenant Governor in Council".

This broadening also is reflected in the decision to employ an outside consultant to make a study of The Future Role of the Saskatchewan Research Council. Dr. Rennie Whitehead of Philip A. Lapp Ltd. made a preliminary report on this study at the December 8, 1978 meeting of Council.

Increased fee-for-service activities, requiring pilot plant and experimental facilities in particular, have exacerbated the space problem. Some relief resulted from the completion of the 12,000 square foot extension to the Annex Building. An additional 6,000 square feet of pilot plant and equipment-testing space in Sutherland will be occupied shortly. An additional materials storage building has been added to the Slurry Pipeline Facility at Quebec Avenue. A test structure for contract work on residential construction methods has been erected at the Outdoor Lab on 115th Street.

In response to increasing complexity of Council's operations a new Senior Management position of Director of Financial Services has been created and filled by Mr. Ron McGrath.

Highlights of this year's work are presented under the following headings:

- Agriculture and Agricultural Processing
- Resource Development
- Industralization
- Environment
- Services

AGRICULTURE AND AGRICULTURAL PROCESSING

SUMMARY

While concerted efforts are directed to diversifying Saskatchewan's economy, agriculture remains the dominating goods-producing industry in the Province. The purpose of SRC's agriculture and agricultural processing program is to complement the work of other agriculturally-oriented agencies to develop and provide appropriate information, processes and technologies to stabilize, diversify and improve Saskatchewan's agriculture and to increase the in-province upgrading of its products.

Many of SRC's 1978 agricultural projects involved cooperation with other agencies. Research and development groups from the Universities, Federal and Provincial governments, business and farmers collaborated with SRC to solve problems of common interest. These interdisciplinary studies involved:

- Farm Products — New Economic Uses
- The Agricultural Environment
- Farm Water Resources.

FARM PRODUCTS — NEW ECONOMIC USES

Straw as Cattle Feed

Investigations have continued regarding the use of straw as a low cost cattle feed when conventional feeds are scarce or expensive.

SRC field tested the AMMONIATION OF STRAW with farmers in Tiny, Saskatchewan as part of a continuing program of research into low cost cattle feeds.

Ammoniation Process

Stacks of straw were treated with ammonia in gas-tight plastic bags as a low cost method to improve the feeding value of the straw. Field trials tested the ammoniation process and funds were provided by the Drought Committee of the Saskatchewan Department of Agriculture (SDA) and Agriculture Canada. This program was a collaboration among SRC, SDA, Agriculture Canada, several fertilizer dealers, a feed manufacturer, farmers, and the Manitoba Department of Agriculture.

Test results indicated that treated straw could provide cheaper feed for wintering cattle, although some problems were identified. During the winter of 1976-1977, the price of feed grain was so low at times that treated straw did not have a cost advantage. Various problems occurred during the ammoniation process and solutions are being sought by improving the technology and management of this process.

In another experiment, green oats were improved in feed value after processing in ammonia released from urea.

This upgrading of low quality feeds should benefit Saskatchewan agriculture through a reduction in feed costs.

Feeding Value of Cereal Straws

The species and variety of a straw affect its feeding value. Therefore, these variables influence how much chemical treatment is needed to bring digestibility to an acceptable level. SRC and Agriculture Canada with partial funding from Supply and Services Canada examined various straws for digestibility value both before and after chemical treatment. This cooperative study showed that even more factors influence straw quality. *Soil fertility and moisture* were important factors in determining straw feeding value. A joint study with Agriculture Canada found that soil treatment gave as much improvement in straw quality as the ammonia process. These results could give Saskatchewan a cheap method of improving a straw's feeding value.

Feeding Value of Residues from Unusual Crops

Faba Bean Crop Residue

These FABA BEAN PLANTS may offer Saskatchewan a new forage crop for processing all parts of the plant as a high quality feed and food.

In cooperation with Agriculture Canada, SRC studied the feeding value of a wide range of crop residue and forages. The *faba bean crop residue* indicated a very high value for sheep feed. In fact, the leaf fraction was high in crude protein and digestibility which suggests that chaff collection would provide maximum feeding value of the faba bean crop residue. In order to expand these findings, a major study was started which covers the feeding value of residues from unusual crops. SRC developed the study along with the University of Saskatchewan's (U of S's) Departments of Chemistry and Chemical Engineering, and Veterinary Physiological Sciences, with financial support from Supply and Services Canada.

Protein Potential in Seeds from Shelter Belt Trees

Neither Siberian elm nor Carragana seeds have high enough protein, oil contents or unusual qualities to warrant further studies for commercial development.

Evaluation of Faba Bean Plant and Residue

In collaboration with the U of S's Crop Sciences Department, SRC found that faba beans might be a source of leaf protein or as a high-energy, dehydrated, whole-plant feed. Furthermore, the faba beans seemed comparable to alfalfa as a dehydrated feed. Therefore, more investigations have been started to determine if faba beans could become a new product for green crop drying plants or combined with other materials in manufactured feeds.

Alfalfa Feed and Food Products

The development of alfalfa products for human and animal consumption is intended to:

- Reduce blood cholesterol levels
- Expand Canadian markets for the alfalfa dehydration industry.

Dr. James Olson of the U of S's Home Economics Department found an alfalfa diet was unacceptable for rats, although the cholesterol levels were reduced. The rat problems centered around harmful substances in normal varieties of alfalfa. Using different varieties from Agriculture Canada, SRC studied methods to reduce or eliminate unwanted components. Several varieties were separated into a leaf-stem fraction through the cooperation of the POS Pilot Plant Corporation. This meal is being tested on rats.

In future studies, SRC will evaluate solvent extraction and enzyme systems designed to remove toxic substances from alfalfa. Subsequent rat feeding tests should determine the effects of those systems.

Eventually, the removal of harmful substances from alfalfa could allow expansion of the processing industry in Saskatchewan.

THE AGRICULTURAL ENVIRONMENT

Herbicide Spray Drift

OFF-TARGET SPRAY DRIFT during pesticide application has been the subject of SRC investigations for over six years.

Off-target spray drift can be reduced to less than one percent when ground-rig sprayers are equipped with particular nozzle and spray solution combinations. While some of the combinations can achieve good drift control, as well as maintain a high degree of pattern uniformity, other approaches cause the spray pattern to worsen or are

applicable only over part of the wind speed range. These results of SRC's six years' research are being communicated to the agricultural community through extension services in the three prairie provinces.

An *air-cushion supported spray boom* was tested by SRC in order to improve the efficiency, speed and drift avoidance for crop spraying operations. By isolating the spray area from the wind, an operator should be able to maintain deposit uniformity over a wide range of wind and tractor speeds. The farmer would benefit in cost reductions through less chemical application, speedier operation and fewer problems from drift. Should some of these benefits be established, the prototype boom needs considerable engineering modification before a practical implement could be marketed. These cost-saving factors seem to justify continued research to perfect the boom.

Livestock Pollution

An AUTOMATIC WATER SAMPLER was installed by SRC personnel to monitor the quality of run-off from feedlots and manure spreading areas in the Pheasant Creek part of the Qu'Appelle basin.

Saskatchewan needed scientific data to determine if livestock operations constitute a threat to the quality of water supplies. SDA's Family Farm Improvement Branch (FFIB) hired SRC to monitor some feedlots and manure spreading areas in the Qu'Appelle basin. In 1978 this large-scale project resulted in SRC's draft guidelines for simple and practical methods to reduce pollution from feedlot operations.

Amendments to Improve Saline Soils

Soil salinity, which inhibits crop production, has become a serious problem in Saskatchewan. In 1976, a project was initiated to:

- Obtain data on the extent and yield loss of affected acreage.
- Test various organic and inorganic soil amendments in context with other SRC studies on straw, manure and coal products utilization
- Look at the movement in the soil of the soluble salts, which cause the salinity problems, particularly in a parkland environment of small hills and depressions.

Measurements of soluble salt movement, and of the effect of different soil amendments, were taken at various locations. This information is being analyzed in conjunction with other studies on soil salinity.

The continuation of these investigations could lead to soil management practices which could benefit Saskatchewan's agricultural economy.

FARM WATER RESOURCES

Freeze Desalination

Spray freezing brackish water utilizes Saskatchewan's frigid winter to provide potable water for human and livestock consumption. This process reduces the salt content in brackish groundwater, the only reliable water supply in much of the settled areas of the province.

Since 1975, under the joint federal-provincial ARDA program, spray freeze trials used a variety of groundwater types and covered a range of climatic conditions. This year the trials were located at Saskatoon, Armley, Blucher, Bruno and Frontier.

The results of these trials demonstrate that small communities using this desalination process could supply enough potable water for the following winter at very low cost. The town of Humboldt is considering spray freezing for additional water supply.

Surface Water Management

Most of the province's surface water comes from snowmelt runoff. Streamflow data from 43 large watersheds and six small SRC watersheds are being used to predict and manage the snowmelt runoff for agricultural use. The study would provide:

- Scientific guidelines for Using Snowfences to Manage Soil Moisture,
- Procedure for Designing and Locating Dugouts to Control Runoff,
- A Method to Predict the Long Term Effects of Wetland Drainage.

Groundwater Supplies

SRC's long-standing hydrology studies have contributed to the technology of *water well development*. These investigations measure and publish the characteristics of water wells and water flow through glacial sediments.

Although glacial till is resistant to water flow, evidence indicates that groundwater can move vertically. Therefore studies to determine vertical groundwater movement will assist in:

- Locating Water Wells, and
- Monitoring Potash Tailings Ponds.

These hydrology data are being stored in a computer to expedite the analysis of groundwater situations.

SRC has considerable groundwater data which can provide reliable water well information for the settled areas of Saskatchewan. Using these data, a person can predetermine the:

- Location
- Depth, and
- Quality

of a water well.

Cloud Seeding

Neighboring provinces and states have seeded chemicals into clouds during weather modification programs. SRC is examining the effects of these chemicals upon Saskatchewan water supplies and soil. Five stations sample air, water and biota in order to trace chemical residuals from weather modification projects. One study found small traces of silver iodide which may influence Saskatchewan precipitation patterns.

SRC GRANTS-IN-AID FOR AGRICULTURE

SRC extends its research capacity with grants-in-aid for a number of agricultural studies at both Saskatchewan Universities, as reported in the section "University Program". These investigations covered:

- Stack Gas Heat for Greenhouses,
- Digestibility of Pea Flour,
- "Flip-over" Disease in Poultry,
- Using Alfalfa to Reduce Cholesterol,
- Potato Hybrids Resistant to Frost
- Field Pea Flour Processing,
- Pollution from Agricultural Areas.

AGRICULTURE AND AGRICULTURE PROCESSING

RESOURCE DEVELOPMENT

INTRODUCTION

The purpose of SRC's Resource Identification and Development Program is to provide technological assistance for the wise exploitation of Saskatchewan's natural resources with emphasis on the in-province upgrading of those resources. Particular emphasis of the program is on natural resource developments in northern Saskatchewan.

IDENTIFICATION

Quaternary Geology of the North

In order to assist the exploration industry, a study was initiated in 1974 to obtain basic data about geology in the Precambrian Shield area of northern Saskatchewan. This study obtained an understanding of the type and distribution of surficial sediments, glacial processes and history of that area.

SRC field crews systematically sampled and recorded geological information for Quaternary Sediments in the Athabasca Sandstone region.

Quaternary sediments were systematically mapped, described, sampled and analysed on a reconnaissance scale. A 60,000 square kilometre area was covered during the year in the Fond du Lac-Lake Athabasca region. The work was done under contract with the Department of Mineral Resources (DMR) as part of a federal-provincial Mineral Development Agreement. This knowledge will provide background information to assist in the solution of many problems related to northern resources. The exploration industry will be aided by an improved interpretation of geochemical information derived from a better knowledge of the sediments.

During the year, a number of contracts were undertaken with exploration companies which involved *Quaternary geology* mapping, sampling and seismic refraction studies.

Groundwater Geology

Hydrology

The location of groundwater by trial-and-error frequently resulted in expensive well development because of a lack of reliable geologic and hydrologic information. SRC's groundwater program has provided reliable information on the location, size, depth and physical properties of aquifers and water quality. These data are available to all people by direct contact with SRC or published reports or maps.

This information can be used for the development, management, allocation and pollution control of groundwater supplies. Farmers continue to be the largest users of groundwater information. However, a consistent increase in usage has been by government, industry and land developers.

The groundwater information data base has grown to the extent that a data storage and retrieval system has been designed for computer use.

SRC began revising the series of geology and groundwater maps published more than 18 years ago. The now obsolete Kindersely map is the first revision. Assistance is being obtained from SDA's Family Farm Improvement Branch for this map revision work.

Evaluation for Future Management

SRC investigated a wide-spread, deep aquifer in the southwestern area of the province. SRC studied this aquifer on behalf of the Saskatchewan Department of the Environment.

A project is underway to develop and update computer digital models which simulate groundwater flow. These models will aid in the interpretation and monitoring of groundwater flow systems.

Metallogenesis of Uranium Deposits

The geology, mineralogy and genesis of Saskatchewan's major uranium deposits are being studied in cooperation with DMR. Currently, the emphasis of the study is on the Gulf Minerals and AMOK deposits. So far, results indicate a complex history of uranium deposition.

The information acquired from this project has enabled the development of a genetic model that can be useful in exploration for new uranium deposits. As a result of this work, the uranium exploration industry has been increasing requests for consulting and analytical services.

Estimating Saskatchewan Coal Resources

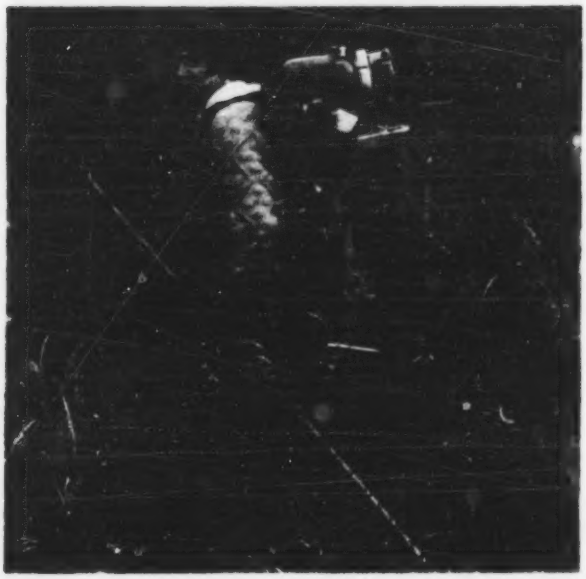
Much information about Saskatchewan's coal resources was obtained from the provincial-federal coal evaluation program initiated in 1971. DMR, the Geological Survey of Canada and SRC undertook portions of the study. Samples were obtained and analyzed from 700 boreholes. From this information, scientists can determine the location and quality of coal in the province.

The large amount of data obtained from this study necessitated development of a computer system to process, store and retrieve the information. This project provides base-line data useful in the development of Saskatchewan coal resources.

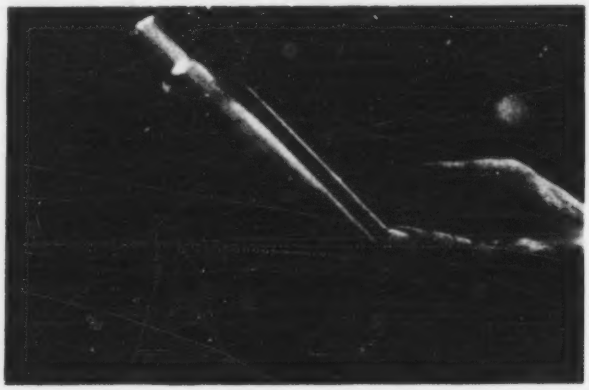
The current phase of the project involves publication of the program's information. Volume I describes the methodology used in the program and will be published this year. In subsequent years, publication of the remaining four volumes will provide detailed data on specific geographic areas. Publication of Volume I is being funded by Energy, Mines and Resources (EMR).

DEVELOPMENT

Geochemical Exploration Methods



A Wacker portable overburden drill was carried by a SRC staff member for a glacial drift sampling project in a remote area in northern Saskatchewan.



A Finnish designed "flow-through" bit is used in conjunction with the Wacker portable overburden drill. This functions as a jackhammer and drives the bit into the ground. The "flow-through" bit retains a sample of sediment when it is pulled up.

Effective exploration in glacial drift requires an extensive understanding of ore metal dispersion processes. One process, the oxidation of glacial sediments, is suspected to be an important variable in influencing metal distributions. To investigate this possibility, sub-surface samples must be obtained. To accomplish this a *portable drill* was tested which drives a "flow through" type bit into the sediments and can retrieve samples from a depth of 40 metres. This special drill was imported from Finland where the glacial geology is similar to Saskatchewan's geology.

A *heavy-mineral separation facility* has been developed to process the samples from the drilling study and other sampling programs. The analysis of heavy minerals derived from glacial sediments is an important technique in uranium exploration. SRC anticipates substantial use of the separation facility by outside organizations involved in drift-sampling projects for mineral exploration.

Resource Corridor Study

A FOREST INVENTORY based on satellite imagery was developed for DNS. This photograph of Clearwater River Valley is an example of the imagery used in the inventory. The original satellite picture was obtained from ISIS Ltd., Prince Albert and was subsequently colour coded using equipment at the Canada Centre for Remote Sensing, Ottawa.

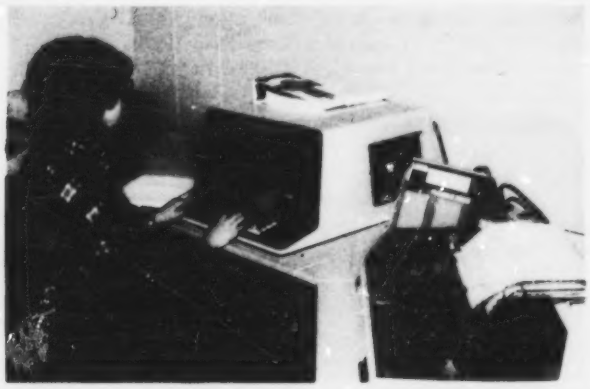
COLOUR KEY: Red — Lakes
White — White Spruce
Yellow — Mature Softwood
Blue — Mixed Softwood
Green — Hardwood
Black — Burn-over or Open Muskeg

To aid in the efficient utilization of land and natural resources of the Cluff Lake road and Clearwater River Valley area, a *land and resources inventory system* has been developed for DNS. This system was designed to assist planners with issues such as development guidelines, land and resource use conflicts, designation of single use areas, implementation strategies and government policy implications.

Ceramic Research

In cooperation with the Saskatchewan Department of Industry and Commerce, SRC continued studies on the utilization of *Saskatchewan raw materials* in the production of *ceramic products*. Investigations concerned the production of ladle brick, electrical grade porcelain and sanitary ware from local kaolinized sand, ball clay and imported feldspar. In addition to the utilization studies, identification of archaeological materials from two sites was done for the environmental impact studies group.

Computer Systems for Resource Development



This dual purpose equipment is used both as a WORD PROCESSOR and as a COMPUTER TERMINAL in order to expedite the use of SRC's scientific information in the development of Saskatchewan's resources.

Computer processable files have been developed for groundwater, meteorological and coal resource data. These files can expedite scientific and technical investigations of Saskatchewan's natural resources. SRC's development of computer systems and programmer analyst services for data processing have been designed to solve specific problems in resource development.

ENERGY REQUIREMENTS

Uranium Industry Energy Consumption

To assist in the assessment of energy consumption in Saskatchewan, the council is studying the uranium industry's usage of energy. This investigation covers the total energy requirements to produce yellow cake uranium and includes consideration of the entire exploration, mining and milling phases of the industry.

Farm Energy Consumption

SRC studied total energy consumption on seven pairs of farms. Within each pair, one farm operator used energy conservation practices while the other did not. Recorded data included fuel consumption and the energy invested in fertilizers, herbicides and machinery. This information indicated that smaller farms have a proportionatey larger investment in machinery energy than larger farms. The project was funded by Supply and Services Canada and SDA.

In a second project, the use of straw as a farm fuel was assessed to determine the amount of straw that can be used safely for energy purposes without adversely affecting the soil. Preliminary estimates indicated that farm fuel required 10 to 20 percent of the total straw production. The loss of straw for fuel usage instead of soil improvement can be offset to some degree by:

- Adequate Fertilization
- Reduced Tillage and Summerfallowing
- More Effective Moisture Retention Practices
- Use of Green Manure Crops.

Straw handling techniques are being studied under contract with the Saskatchewan Department of Industry and Commerce.

GRANTS-IN-AID FOR RESOURCE DEVELOPMENT STUDIES

SRC has supported a few resource development studies at the University of Saskatchewan as reported in the section "University Program". These investigations were concerned with:

- Liquid Fuel from Wood and Straw
- Slurry Pipeline Additives.

INDUSTRIALIZATION

OBJECTIVE

The purpose of SRC's Industrial Development Program is to develop, provide and promote the application of those appropriate processes, technologies and management techniques which will improve the productivity of Saskatchewan industry and its supporting infrastructure and increase the value-added of its products and services.

PRODUCTION ENGINEERING AND MANAGEMENT TECHNOLOGIES

A PRODUCTION MANAGEMENT SEMINAR was presented by SRC's management consultants to a group of Saskatchewan manufacturers in Saskatoon.

Management Consulting

This group has undergone rapid expansion. During 1978 services to clients included:

- Feasibility Studies
- Market Surveys
- Productivity Reviews
- Production Planning and Control
- Financial Assessments
- Organizational Studies

The *management consulting group* also has designed and installed cost accounting systems and incentive plans. This group presented *seminars* for industrial management upgrading. Participants were given individual consulting follow-ups which generated a benefit-cost ratio of more than ten times for these Saskatchewan companies.

NRC's Technical Information Service

In Saskatchewan, SRC operates the National Research Council's (NRC) *Technical Information Service (TIS)*. Clients are given technical assistance in areas such as technical process problems, painting, corrosion and environmental problems. Industrial engineering assistance is provided for production planning and control methods and productivity improvement, plant layout, cost accounting and product pricing. This year, TIS assisted over 450 Saskatchewan manufacturers.

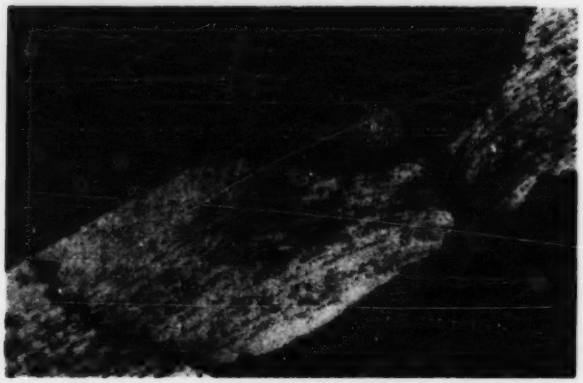
Product Design

SRC's product design and improvement service offers manufacturers a computer analysis which is unique in western Canada. This service provided clients with dollars savings through:

- New Products Design
- Product Improvement
- Reduction in Field Testing
- Savings in Raw Materials
- Expanded Markets
- Creation of New Jobs
- Support Data for Contract Bids

In 1978 using computer techniques this group *designed* eight *new* products and *improved* 16 products. This program strengthened the reliability of Saskatchewan-made products and provided a faster response to market demands.

Welding Technology



This Photomicrograph shows STRESS CORROSION CRACKING in a stainless steel stack which carries steam from a potash drier. SRC's investigation found that the cracking was caused by minute amounts of chlorine in the steam and the stress produced by welding.

In conjunction with NRC and the Canadian Welding Development Institute, SRC maintains *a welding technology assistance program* for local manufacturers. This service provides:

- Advice to Improve Welding Processes
- Failure Analyses
- Welding Metallurgy Courses for supervisors and managers.

During 1978, the welding program handled 76 technical inquiries, produced 12 failure analyses and presented three seminars. The program helped these Saskatchewan manufacturers become more competitive through reduction in product failures and decreases in production costs which provided a benefit/cost ratio of over 100 to 1.

Industrial Consulting

Under the NRC's IRAP program, SRC's mechanical engineering consultants supplied performance data for a Saskatchewan firm's factory produced building which indicated the structure's ability to withstand high winds and heavy snow loads. Using this information, the company was able to expand and maintain sales in new market areas.

Technology Publications

SRC publishes two periodicals for over 4,000 industrial subscribers. Both *Industrial Business Management Technology* and *Techread* are designed to assist further upgrading of Saskatchewan industry.

Industrial Business Management Technology deals with applied management technology. This publication contains contributions by SRC's Industrial Services Division plus reprints of relevant articles from almost 100 management periodicals.

Some of the titles in 1978 were:
- A Common Sense Approach to Productivity Improvement
- Are You a Decision Maker
- Organization Review will Improve Your Productivity
- How to be Creative

Techread is concerned with manufacturing technology. Through a selective technology transfer system, *Techread* also provides limited distribution of specific items to particular subscribers. This system avoids cluttering industries with irrelevant information. Contributions by SRC staff members included:

- What to Invent
- The Canadian Welding Development Institute

PHYSICAL PROCESS CONSULTATION

Pipeline Transportation of Solid Materials

The SLURRY PIPELINE facility at SRC investigates the transport of solid materials through pipelines. Short pipelines can be used to dispose of industrial wastes and longer pipelines can have considerable economic advantages over trucking or rail transport.

Water Slurry

SRC is continuing research into the hydraulic transport of solids through pipelines. The raw materials are mixed with water, pumped through the lines as a slurry and then separated from the liquid at the terminal.

Short pipelines are used to dispose of wastes from mining operations and processing plants. Longer pipelines can have economic advantages over trucking or rail transportation.

SRC's pipeline facility has earned worldwide recognition as a centre of excellence in transport by slurry. The centre functions under contracts with the federal government and private industry. The latest contract is for a study of the hydraulic transport of "tar sand" tailings.

Coal-Oil Slurry

Coal can be used to meet energy requirements until the establishment of alternate resources. SRC scientists have investigated a *coal-oil slurry* instead of a coal-water slurry, in a project financed by the federal Department of Energy, Mines and Resources (EMR). Results of this project indicate that in addition to pipeline transportation, the combustion of a coal-oil slurry could be used as a fuel which would reduce oil consumption. SRC scientists also found that a coal-oil slurry could expedite feeding coal into high pressure reactors.

Insulation from Wood Waste

SRC has studied methods of utilizing wood waste in the manufacture of insulating materials. This project was sponsored by the Department of Northern Saskatchewan (DNS).

Potash Research

"Creep" Monitoring

In a potash mine, for safety reasons, about 60% of the available ore must be left in place as a "roof" support.SRC has designed and built a number of instruments which monitor rock pressures or "creep". Using data from these monitors, miners can extract *safely* a greater portion of the ore, thus reducing operating costs and extending mine life. The project was funded by EMR and tested at the Cominco mine.

Laboratory Testing

Under contract from the provincial Department of Mineral Resources (DMR), SRC has designed and built a *Potash Creep Testing Laboratory*.

Practical Energy Conservation

Since the design and construction of the energy conservation house in Regina, SRC has increased its interest in *practical energy conservation*. The conservation house demonstrated that better insulating and conservation practices could reduce home energy requirements by 90%.

This year, special computer programs have been developed to aid the evaluation of solar energy and conservation projects. For example, a number of energy saving ideas were incorporated into Saskatoon's Harry Bailey Aquatic Centre. SRC also has examined ways to improve energy utilization in potash refining.

Thermal Energy Storage

SRC investigated the use of sodium sulphate to *store off-peak electrical or solar energy* for later use.

Economic utilization of solar energy or off-peak electrical energy requires a storage medium to maintain a continuous supply of stored heat. Sodium sulphate has better thermal storage properties than water or rocks. This process could provide new markets for Saskatchewan's sodium sulphate industry.

The project was approved by NRC's IRAP program and financed by Saskatchewan Minerals.

Water and Sewer Utilities in Northern Saskatchewan

DNS contracted with SRC to monitor soil and pipe temperatures at the northern townsites of La Loche, Buffalo Narrows, Weyakwin and Cumberland House. This program now is in its fourth and final year. The results will be used by civil engineers in determining the most economic designs for water and sewer distribution systems in northern locations.

SRC GRANTS-IN-AID FOR INDUSTRIALIZATION

SRC awarded grants-in-aid for several industrial research projects conducted at the Universities of Regina and Saskatchewan which are reported under "University Program". These studies dealt with:

- Housing Satisfaction
- Photovoltaic and Photoelectric Assisted Electrolysis of Water.

ENVIRONMENT

INTRODUCTION

The environmental research program at SRC is undertaken to provide a broad understanding of how present and future agricultural practices, resource extraction and industrial operations may affect the physical and biological environment of Saskatchewan. Secondly, the program is designed to develop equipment, technical skills and consulting expertise in these areas, so that SRC may undertake environmental impact assessments for various provincial departments and industries.

PLANKTON SAMPLES were collected by an SRC scientist as part of an environmental impact assessment.

ENVIRONMENTAL ASSESSMENTS

The *Environmental Studies Group* undertakes investigations which likely would otherwise be done by companies from outside Saskatchewan. SRC provides a continuing environmental consulting service in the fields of air quality, aquatic and terrestrial ecology, hydrology and archaeology. Although the majority of this work is done under contract, a basic development program has begun on a small scale through the use of internal funds.

Activities

Studies were undertaken during 1978 for two major environmental impact assessments and numerous overview assessments which included access road construction, uranium mine expansion and hydroelectric power development.

Archaeology

Numerous environmental studies required archaeological investigations. Some of these studies provided background for proper assessment of proposed construction projects. Two projects involved the collection of information for the educational management of archaeological sites in Saskatchewan.

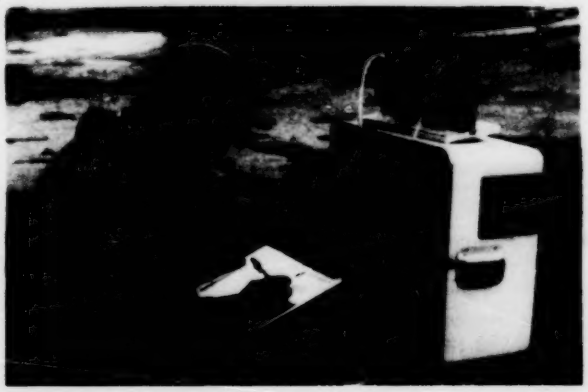
An SRC ARCHAEOLOGICAL FIELD CREW recorded information at the site of an historic Inuit camp. This study provided planning information for the Parks Canada development near Churchill, Manitoba.

AIR

Sulphur Concentrations in Northern Saskatchewan

A good inventory of existing sulphur concentrations in the atmosphere over northwestern Saskatchewan is required before the Athabasca tar sands are developed extensively. Sulphur concentrations have been recorded by SRC under contract with Environment Canada. This information will provide the basis for protecting Saskatchewan's vegetation and wildlife from pollution by Alberta's industry.

Dust Emissions from Potash Plants



STACK SAMPLING of the dust emissions from a potash mine were studied by an SRC scientist.

Provincial regulations limit dust emissions from the stacks of potash plants.

SRC developed a team to monitor these emissions because the potash companies requested assistance in stack sampling. With cooperation from the industry, this service will develop as the centre of emissions data for the potash industry of Saskatchewan. Most of the province will benefit from a reduction in nuisance and damage from salt dust emissions.

Dust in a Horse Barn

During winter, coughing is common in stabled horses. In conjunction with the Western College of Veterinary Medicine (WCVM), SRC began a project to find the source of this infection. The air in these stables was sampled for dust. The source and transport media of the infection have been identified as fine particles which originate inside the stable. This project might be extended to survey horse stables in the four western provinces served by WCVM.

Occupational Hazard Studies

Exposure to Pesticides

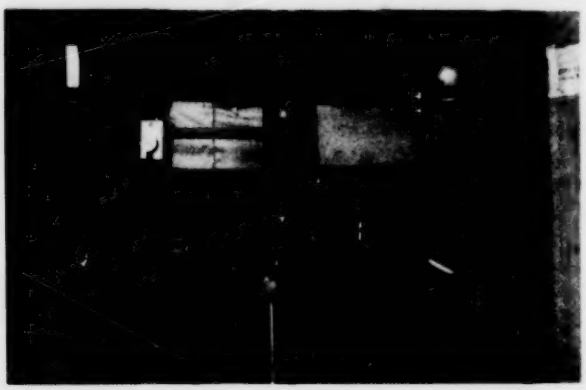
Personnel carrying out aerial spray programs are exposed to the pesticides used in this operation. In order to determine the extent of this exposure, samples of the exposure to individual crew members were collected and analyzed by SRC under a contract with a chemical industry. The occupational hazards of spraying operations can be assessed from this information. The hazards are becoming a serious concern among health authorities.

Dust in Tractor and Combine Cabs

Farmers are exposed to dust during farm operations. There is little information on the extent of this occupational hazard in Saskatchewan.

Field samplings were made of dust generated by farm machines from seeding to harvest time. Results indicate that the amount of respirable dust was highest in seeding operations which exceeded the dusty combine harvesting.

Grain Dust in Elevators



GRAIN DUST in an elevator was measured by using special instruments installed and recorded by an SRC scientist.

Elevator operators are exposed to grain dust in their working environment. A systematic study has been initiated to find out the extent of this health hazard. This project involves SRC in collaboration with the U of S's Division of Pulmonary Medicine under the Saskatchewan Studies on Grain Dust program which is supported by Health and Welfare Canada.

During the fall-winter season, the SRC group sampled dust in 40 elevators in the eastern half of the province. SRC's activity also is to supplement the grain-dust surveillance program initiated by Labour Canada, Occupational Safety and Health Branch.

A dust chamber was constructed for use by the medical pathologists. In this chamber, animals will be exposed to grain dust of known origin and properties.

This study will establish the hazards of grain dust to elevator operators and enable remedial action to be taken.

WATER

Urban Runoff Measurements

Saskatoon's Idylwyld underpass had to be designed without adequate rainfall data for high intensity storms. As a result, the pumping station has twice the capacity required and maintenance costs are 20% higher. A project was commenced to provide such data for further construction projects.

For eight years, SRC has collected rainfall-runoff data at the Idylwyld underpass. Eventually, the data will be used to provide guidelines in the design of urban areas with respect to storm drainage under Saskatchewan conditions. These guidelines would involve the treatment of pollution in storm water introduced by rain and snow-runoff from pavement, heavily fertilized lawns and gardens with high pesticide applications.

Using Aquatic Plants for Sewage Treatment

Rural communities in Saskatchewan lack a cheap method of sewage disposal which doesn't pollute the water-courses. SRC, in search of such a method, studied the use of aquatic plants to remove nutrients from polluting effluent.

Experiments were continued during 1978 under controlled growth chamber conditions which proved the effectiveness of bulrush and cattail to remove the nutrients. Techniques for designing aquatic plant lagoons have been developed and used to plan a demonstration unit.

Results from the growth chamber and a demonstration project should provide economic data about using aquatic plants as a tertiary treatment for sewage effluent from rural communities. At present, this method appears to be an inexpensive way for rural localities to meet future, more stringent pollution regulations.

SRC's study also has shown that aquatic plants grown in sewage effluent are rich in protein. The plants could be harvested and used as an animal feed which is another benefit for a rural community.

LAND

Environment Guidelines for Transportation Projects

This project was initiated by the Saskatchewan Department of Environment to produce guidelines for proponents of projects involving roads, highways, electrical transmission lines, oil and gas pipelines.

For over a year, SRC staff developed guidelines to aid designers and planners in their consideration of all environmental factors pertaining to transportation projects under Saskatchewan conditions. Nine SRC staff members contributed to the project and expert opinions were solicited from over 25 environmental specialists outside of SRC. Two reports were produced:

- Guidelines for Environment Assessment
- Guidelines for Mitigation Measures.

The guidelines will provide developers with the means to ensure that all aspects of environmental dislocations and their mitigation are incorporated into the final design of a transportation development.

GRANTS-IN-AID FOR ENVIRONMENTAL STUDIES

SRC supported a number of environmental oriented studies as reported in the section "University Program".

These studies included work in:

- Chlorinated Hydrocarbons in Saskatchewan Water,
- Sediments of the Upper Qu'Appelle River Basin,
- How Microwaves Control Iron Bacteria in Water Wells,
- Mechanics of Landslides on Valley Walls,
- The Vegetation and Climatic History of Northern Saskatchewan,
- Search for a Better Method of Reporting Lake Sediment Data.

SERVICES

INTRODUCTION

SRC maintains special competence to serve unique requirements for services that are not available in Saskatchewan. These specialized services are provided to SRC projects and on a contractual basis to outside clients. The activities are grouped under the headings: chemical analysis, graphics, workshops and special service facilities.

CHEMICAL ANALYSIS

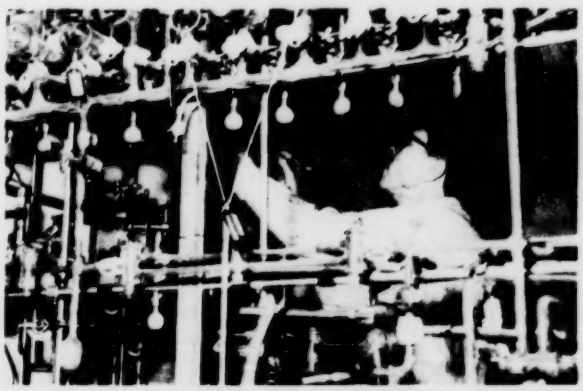
Analytical and Radioanalytical Chemistry

An increase in the amount of WATER SAMPLES analyzed by SRC's chemistry laboratory has necessitated an expansion of this facility.

The main areas of activity were water analysis, radiochemistry and trace analysis. Water and trace element analyses continued, with growth in the number of samples handled.

The radiochemical area experienced major growth this year. Three automatic counting systems have been acquired which can process up to 50 chemical analysis a day. A gamma spectrometer will be added to the laboratory to measure low levels of various naturally-occurring radionuclides in environmental samples. A manual of radiochemical procedures for mine-mill laboratories was prepared under contract for the Canmet Laboratories of EMR.

Carbon 14 Dating Laboratory



SRC's CARBON 14 DATING LABORATORY is the only facility of its kind in Western Canada.

This facility, as one of the few in Canada, worked to full capacity for another year.

Most of the analyses for determining the age of specimens were supplied under contract to EMR which includes the Museum of Man and the Geological Survey of Canada. The rest of the work was performed for Universities, research councils, archaeological societies and other government departments from Western Canada.

Geochemical Analysis Laboratory

This unit specializes in trace metal analysis of rocks, soils and lake sediments. Over 30,000 samples were analyzed in 1978. SRC developed a new uranium analysis system with computerized data acquisition for the rapid handling of uranium ore sample assays.

GRAPHICS

Graphics and Cartography

Most activities in this area involve map cartography, photomosaics and the preparation of specialized brochures. The major effort of this section involved the

publication of a 56 page full-colour atlas with a 156 page text entitled *Coal Resources of Southern Saskatchewan: A Model for Resource Evaluation.* The group coordinated input from the Geological Survey of Canada, DMR and SRC. The project included subcontract supervision of the photomechanical and other printing stages.

Another major project was the publication of the *Fort Qu'Appelle Geolog* which described in laymen's language the topography, geology and biological environment of this area. The booklet, which was designed for use in parks and tourism operation, was produced for the Saskatchewan Department of Culture and Youth.

This section also produced photo-mosaics and special imagery packages for a number of purposes, in particular for survey coverage of the extreme north of the province and for potash mine surveillance flights in the south.

Instrumentation Graphics and Design

This group prepares the description and specifications for some of the equipment designed and built by SRC. The group also helps document methodology related to scientific tests and measurements.

The major undertaking for this group in 1978 was the preparation of Volume I for a report on the quality assessment of coal for Southern Saskatchewan. The report required the production of photographs, illustrations and separation negatives for press runs. Beyond this project, the group produced a comprehensive manual for equipment designed under contract. This group completed the circuit diagrams and figures for the manual.

WORKSHOPS

Engineering Workshops

SRC requires facilities for the design, construction, operation and maintenance of field and large laboratory equipment. These services are provided by the Engineering Workshops which also are responsible for routine maintenance and repair of SRC's buildings.

The move to the Annex Extension required considerable involvement of shop facilities both in finishing the new space and renovating old areas for new uses. Continued space limitations required workshop ingenuity in the construction of special laboratory facilities for some short-term contractual projects, notably walk-in chambers in the pilot plant area.

Precision Instrument Laboratory

This shop produces specialized scientific equipment whenever a particular device cannot be purchased for the required task. Instrumentation services were concentrated on construction and sale of rotary fusion furnaces, used in sample preparation by the uranium industry and on water level recorders for various groundwater projects.These instruments are used by government departments and other agencies in several Canadian regions.

Mechanical servicing of special equipment by the *Precision Instrument Shop* is expected to grow further as more complex devices are set up in Saskatchewan mining companies.

Ice water was used to test a special TEMPERATURE PROBE which was designed and built by SRC's PRECISION INSTRUMENT LABORATORY.

Electronics Laboratory

This service includes consultation, design, fabrication and maintenance of electronic instruments and systems. This group built an automatic unit on a fluorometer for more rapid and efficient sample analyses. Microcomputers also have been built and installed on several analytical instruments which speed-up the calculation and conversion stages. Five peak-shaving controllers were built to enable more efficient power allocation in homes and residential areas. The controllers were produced under contract with the Saskatchewan Power Corporation, to be manufactured under license for widespread public use.

SPECIAL SERVICE FACILITIES

The Climatological Reference Station

This service continued to function as the basic "benchmark" site for such data in Saskatchewan, which provided weather information and advice to a variety of clients. The station operation is in its 17th year with funding, in part, through a contract with the Atmospheric Environment Service.

Steps were commenced to automate a major portion of the data-gathering task to enable more rapid dissemination of the information and to obtain more efficient use of staff.

Technical Library

During the year, the library moved into greatly expanded facilities and was able to consolidate various holdings. As a result of this move, a considerable improvement developed in the provision of information both to SRC staff and to outside users. The SRC library consists of over 12,000 books, 400 journal subscriptions, numerous reports and pamphlets.

GRANTS-IN-AID

SRC awarded a grant-in-aid to the University of Saskatchewan for the development of microprocessors for patient-monitoring aids as mentioned in the section under "University Program".

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THE UNIVERSITY PROGRAM

SCHOLARSHIPS

The Government of the Province of Saskatchewan offers graduate research scholarships tenable at either the University of Saskatchewan or the University of Regina. The purposes of the awards are to assist graduate students to prepare for careers in scientific and industrial research, and to create interest in the exploitation of Saskatchewan's resources and in techniques that will advance in the development of the Province. SRC conducts the selection of the candidates.

Awards valued at $5,000 for the year beginning October 1, 1978 were made to:

Ms. A. E. McCann, Biology, University of Regina

Ms. B. Kirkpatrick, Animal Science,
University of Saskatchewan

R. G. Kachanoski, Soil Science,
University of Saskatchewan

Dr. Patricia Tones, scholarship winner in 1973, now is a member of SRC's staff.

GRANTS-IN-AID

Since its creation in 1947, the Saskatchewan Research Council has provided grants to applicants in Saskatchewan Universities for applied research in the sciences. Eighteen grants totalling approximately $87,000 were awarded in 1978 to applicants at both the University of Saskatchewan and the University of Regina.

The following projects presently are receiving support under the grants-in-aid program:

UNIVERSITY OF REGINA

DEPARTMENT OF BIOLOGY

The Application of Microwave Technology to the Control of Specified Micro-biological Problems in Saskatchewan
Under the direction of Professor D. R. Cullimore.

Phosphorus Metabolism in High-protein, Frost Resistant Potato Hybrids
under the direction of Professor W. A. Quick.

DEPARTMENT OF GEOLOGICAL SCIENCES

Implications of Using Volume Measurements in the Interpretation of Lake Sediment Exploration Data
under the direction of Professor G. R. Parslow.

DEPARTMENT OF PHYSICS AND ASTRONOMY

Photo-voltaic Photoelectric Assisted Electrolysis of Water
under the direction of Professor J. F. Kos.

UNIVERSITY OF SASKATCHEWAN

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING

Liquid Fuels from Aspen Poplar and Wheat Straw
under the direction of Professors R. L. Eager, J. F. Mathews and J. M. Pepper.

Lignite as a Pipeline Additive
under the direction of Professor C. A. Shook.

DEPARTMENT OF CIVIL ENGINEERING

Inventory of Chlorinated Organics in Saskatchewan Surface Water Supplies
under the direction of Professors E. Davis and D. J. L. Forgie.

Measurement of Pollution from Agricultural Areas
under the direction of Professor T. H. Lackie.

The Mechanics of Retrogressive Landslides
under the direction of Professor J. Krahn.

DEPARTMENT OF CROP SCIENCE

Digestibility Studies on Pea Protein Concentrate
under the direction of Professor R. S. Bhatty.

DEPARTMENT OF GEOLOGICAL SCIENCES

Vegetational and Climatic History of Northern Saskatchewan
under the direction of Professors W. O. Kupsch, J. S. Rowe and W. A. S. Sargeant.

DEPARTMENT OF HOME ECONOMICS

The Effect of Alfalfa Leaf Fibre on Hepatic Sterol Metabolism on the Fate and Carcass Distribution of Cholesterol and Bile Acids
under the direction of Professor J. P. Olson.

Modification of Field Pea Flour and Protein Concentrate Properties
under the direction of Professor A. K. Sumner.

DEPARTMENTS OF HORTICULTURAL SCIENCE AND MECHANICAL ENGINEERING

Utilization of Stack Gases from a Coal-fired Boiler for Greenhouse Vegetable Production
under the direction of Professors E. A. Maginnes and G. H. Green.

DEPARTMENT OF PHYSICS

Micro Processor-based Patient-monitoring System
under the direction of Professor K. V. Paulson.

DEPARTMENT OF PSYCHOLOGY

Housing Satisfaction
under the direction of Professor K. V. McDowell.

DEPARTMENT OF SOIL SCIENCE

Nature and Physico-Chemical Properties of Selected River and Stream Sediments in the Upper Qu'Appelle River Basin in Saskatchewan
under the direction of Professor P. M. Huang.

DEPARTMENT OF VETERINARY PATHOLOGY

A Search for the Cause of Acute Death Syndrome ("flip overs") in Broiler Chickens
under the direction of Professor C. Riddell.

Copies of all papers published in the literature and of all theses resulting from grants-in-aid support by the Saskatchewan Research Council are available at the Saskatchewan Research Council library.

STAFF OF THE SASKATCHEWAN RESEARCH COUNCIL

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Pepper, T. P.	B.A., M.A., Ph.D. — Executive Director
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McGrath, R. J.	B.Sc., M.B.A., R.I.A. — Director of Financial Services
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THE SASKATCHEWAN RESEARCH COUNCIL

FINANCIAL STATEMENT

Year Ended March 31, 1978

AUDITOR'S REPORT

To the Members of the Legislative Assembly
of the Province of Saskatchewan:

I have examined the balance sheet of the Saskatchewan Research Council Fund as at March 31, 1978 and the statement of operations and balance of fund for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Fund as at March 31, 1978 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Regina, Saskatchewan,
June 29, 1978

W. G. LUTZ, C.A.
Provincial Auditor.

SASKATCHEWAN RESEARCH COUNCIL FUND

NOTES TO FINANCIAL STATEMENTS

March 31, 1978

1. Accounting Policies

(a) Fixed Assets

(i) The Saskatchewan Research Council utilizes funds accounting wherein all receipts and expenditures including those for fixed assets appear in the statement of revenue and expenditure. To maintain accountability for fixed assets, it is necessary to record them as a balance sheet asset with a corresponding entry to "Equity in Fixed Assets". Because asset purchases and sales appear in the statement of revenue and expenditure, no provision has been made for depreciation of fixed assets.

(ii) The Council's policy is to remove the cost of all equipment from the accounts which have:
— become obsolete during the year
— been sold during the year
— been in service for ten years.

(b) Principles of Consolidation

The Council's subsidiary does not follow fund accounting practices adhered to by the Council. As a result of the incompatibility of accounting practices the accounts of the subsidiary are not consolidated with those of the Council but are accounted for by the equity method.

2. Shareable Costs Recoverable

Under the terms of an agreement, which expires in December, 1978, with the Federal Government Agency administering The Agricultural Rehabilitation Development Act, the Council is allowed to recover from the Agency one half of all eligible expenditures it has incurred on the Ground Water Study.

As at March 31, 1978 the Council had received all but $43,051 of the total expenditures claimed for the year.

3. Employees' Pension Fund

The actuary of the Employee's Pension Fund, stated in his report dated July, 1975, that as at May, 1974 there was a deficiency in the Fund, in respect to past service benefits, of $88,613. In order to liquidate this deficiency the Saskatchewan Research Council must and is making fifteen annual instalments of at least $8,861 into the Pension Fund.

The report also indicates that the Council's contributions for the cost of benefits in future years be at the rate of 139.81% of required employee's contributions.

4 Loan Payable — Province of Saskatchewan

This loan is bearing interest at a rate approximating the prime lending rate and is repayable upon demand of the Minister of Finance. Subsequent to the year-end the loan was repaid in full.

5. Investment in Subsidiary

The Council's subsidiary was incorporated under The Companies Act of Saskatchewan on December 3, 1976 and has been inactive since that date.

M121

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Statement 1

SASKATCHEWAN RESEARCH COUNCIL FUND

BALANCE SHEET

March 31, 1978
(with comparative figures at March 31, 1977)

ASSETS

	1978	1977
Current:		
Cash in bank	$ 18,375	$ 55,596
Guaranteed savings deposit	12,537	642,835
Investments, at cost which approximates market value	160,000	60,000
Accounts receivable	925,655	383,062
Shareable costs recoverable (Note 2)	43,051	24,070
Prepaid expenses	18,069	16,221
Total current assets	1,177,687	1,181,784
Investments, at cost which approximates market value	20,000	—
Deferred finance changes	5,842	9,331
Investment in and advance to subsidiary (Note 5)	2,895	2,055
Equity in Saskatoon Co-operative Association	257	202
	3,152	2,257
Fixed: at cost		
Laboratory equipment	1,001,417	816,470
Building	491,017	145,257
Automotive equipment	174,825	164,919
Furniture and fixtures	154,094	139,532
Shop equipment	63,138	60,286
Land	10,000	10,000
	1,894,491	1,336,464
	$3,101,172	$2,529,836

LIABILITIES

	1978	1977
Current:		
Accounts payable	$ 304,820	$ 245,943
Employee deductions payable	86,227	102,200
Loan payable — Minister of Finance (Note 4)	200,000	200,000
Principal portion of agreement payable	4,621	3,808
Total current liabilities	595,668	551,951
Agreement payable: repayable in monthly instalments of $608 including interest	27,358	34,668
Less portion shown as current liability	4,621	3,808
	22,737	30,860

EQUITY

Equity in fixed assets (Schedule 2)	1,894,491	1,336,464
Balance of fund (Statement 2)	588,276	610,561
	2,482,767	1,947,025
	$3,101,172	$2,529,836

(See accompanying notes to the financial statements)

Statement 1

SASKATCHEWAN RESEARCH COUNCIL FUND

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(See accompanying notes to the financial statements)

Statement 2

SASKATCHEWAN RESEARCH COUNCIL FUND

STATEMENT OF OPERATIONS AND BALANCE OF FUND

Year Ended March 31, 1978
(with comparative figures for the 1977 year)

	1978	1977
Revenue		
Province of Saskatchewan — grant	$2,575,350	$2,281,400
Other grants, contracts and fees from industry	2,310,457	1,889,430
	4,885,807	4,170,830
Expenditure (Schedule 1)	4,876,996	3,970,964
Excess of revenue over expenditure before the following:	8,811	199,866
Other income	55,522	33,413
	64,333	233,279
Research grants	86,618	58,304
Excess of revenue over expenditure (expenditure over revenue) for the year	(22,285)	174,975
Balance of fund, beginning of year	610,561	435,586
Balance of fund, end of year	588,276	610,561

(See accompanying notes to the financial statements)

SASKATCHEWAN RESEARCH COUNCIL FUND

SCHEDULE OF EXPENDITURES

Year Ended March 31, 1978
(with comparative figures for the 1977 year)

	Admin.	Chem.	Eng.	Geology	Ind.	Physics	Man. Consult.	1978 Total	1977 Total
Employee benefits	$ 70,076	$ 33,605	$ 56,980	$ 34,149	$ 18,693	$ 42,153	$ 3,718	$ 259,374	$ 169,624
Fixed asset purchases	376,452	48,627	38,420	98,479	33,709	32,229	2,045	629,961	247,336
Other	241,607	35,162	77,389	38,962	18,778	16,214	6,925	435,037	245,394
Salaries	239,767	477,446	621,586	456,647	196,388	379,528	63,836	2,435,198	2,227,058
Supplies	23,461	48,124	254,477	48,741	37,521	25,163	2,098	439.585	283,279
Technical services	53,281	40,033	189,312	141,289	28,168	62,118	4,651	518,852	634,124
Travel and vehicle operations	15,853	12,251	41,452	42,601	20,430	16,612	9,790	$ 158,989	164,049
	$1,020,497	$695,248	$1,279,616	$860,868	$353,687	$574,017	$93,063	$4,876,996	$3,970,964

(See accompanying notes to the financial statements)

Statement 2

SASKATCHEWAN RESEARCH COUNCIL FUND

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Other	241,607	35,162	77,389	38,962	18,778	16,214	6,925	435,037	245,394
Salaries	239,767	477,446	621,586	456,647	196,388	379,528	63,836	2,435,198	2,227,058
Supplies	23,461	48,124	254,477	48,741	37,521	25,163	2,098	439,585	283,279
Technical services	53,281	40,033	189,312	141,289	28,168	62,118	4,651	518,852	634,124
Travel and vehicle operations	15,853	12,251	41,452	42,601	20,430	16,612	9,790	$ 158,989	164,049
	$1,020,497	$695,248	$1,279,616	$860,868	$353,687	$574,017	$93,063	$4,876,996	$3,970,964

(See accompanying notes to the financial statements)

Schedule 2

SASKATCHEWAN RESEARCH COUNCIL FUND

SCHEDULE OF EQUITY IN FIXED ASSETS

Year Ended March 31, 1978
(with comparative figures for the 1977 year)

	1978	1977
Equity in fixed assets, beginning of year	$1,336,464	$1,182,880
Add: Fixed asset additions (Schedule 1)	629,961	247,336
	1,966,425	1,430,216
Deduct:		
Fixed asset disposals		
— written off (Note 1)	47,351	84,142
— sold	24,583	9,610
Equity in fixed assets, end of year	$1,894,491	$1,336,464

(See accompanying notes to the financial statements)

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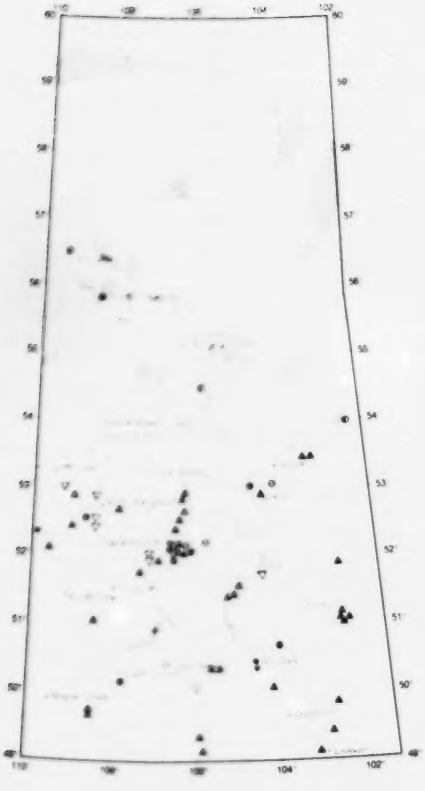
(See accompanying notes to the financial statements)

LOCATION OF SASKATCHEWAN RESEARCH COUNCIL FACILITIES



EXPLANATION

- ▲ Observation well
- ● Sewer and water study
- ▪ Pesticide sampling site
- ◉ Spray freezing site
- ● Slough study
- + Ice crossing study
- ▽ Watershed